

WAR DEPARTMENT

BASIC FIELD MANUAL



Volume III
BASIC WEAPONS

PART SIX
ANTIAIRCRAFT MARKSMANSHIP
INFANTRY WEAPONS

CHAPTER 1
GENERAL

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BASIC FIELD MANUAL

Volume III BASIC WEAPONS

PART SIX ANTIAIRCRAFT MARKSMANSHIP INFANTRY WEAPONS

CHAPTER 1 GENERAL

Prepared under direction of the
Chief of Infantry



UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1936

For sale by the Superintendent of Documents, Washington, D. C. - Price 5 cents

WAR DEPARTMENT,

WASHINGTON, *May 26, 1936.*

Chapter 1, General, Part Six, Antiaircraft Marksmanship—
Infantry Weapons, Basic Field Manual, Volume III, Basic
Weapons, is published for the information and guidance of all
concerned.

[A. G. 062.11 (11-5-35).]

BY ORDER OF THE SECRETARY OF WAR:

MALIN CRAIG,
Chief of Staff.

OFFICIAL:

E. T. CONLEY,
Major General,
The Adjutant General.

II

FOREWORD

Basic Field Manual, Volume III, Basic Weapons, will be published in six parts as follows:

PART ONE. Rifle company. (Each chapter of Part One will be published as a separate pamphlet.)

Chapter 1. Rifle marksmanship.

2. Automatic rifle marksmanship.
3. Automatic pistol marksmanship.
4. Instruction with the bayonet.
5. Instruction with hand and rifle grenades.
6. Musketry.

PART TWO. Fire-control instruments.

Chapter 1. Machine-gun instruments.

2. 37-mm gun and 3-inch trench mortar instruments.
3. Care, repair, and adjustment of instruments.

PART THREE. Machine-gun company.

Chapter 1. Mechanical training with the machine gun.

2. Machine-gun marksmanship.
3. Technique of machine-gun fire.
4. Barrages and concentrations.

PART FOUR. Howitzer company.

Chapter 1. Mechanical training with the 37-mm gun and the 3-inch trench mortar.

2. 37-mm gun and the 3-inch trench mortar marksmanship.
3. Technique of fire of the 37-mm gun and the 3-inch trench mortar.

PART FIVE. Combat practice firing.

Chapter 1. General.

2. Rifle company.
3. Machine-gun company.
4. Howitzer company.

PART SIX. Antiaircraft marksmanship—Infantry weapons. (Each chapter of Part Six will be published as a separate pamphlet.)

Chapter 1. General.

2. Rifle and automatic rifle.
3. Machine gun, caliber .30.

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BASIC FIELD MANUAL, VOLUME III

BASIC WEAPONS

PART SIX

ANTIAIRCRAFT MARKSMANSHIP—INFANTRY WEAPONS

CHAPTER 1

GENERAL

The matter contained in this chapter, together with that contained in chapters 2 and 3, supersedes TR 300-5, November 15, 1928.

SECTION I

GENERAL

1. **Scope.**—This chapter covers the general application of infantry antiaircraft fires.

2. **Tactical doctrine.**—In principle, combatant arms take the necessary measures for their own immediate protection against low-flying hostile aircraft. Special antiaircraft guns and units will generally be employed in the defense of critical points or areas such as supply bases, railheads, airdromes, transportation lines, concentration areas, industrial plants, and the areas in rear of the division artillery. *Infantry must therefore be fully trained and imbued with the determination to protect itself against hostile aerial attacks without reliance upon special units or other arms of the service. Concentrated rifle and machine-gun fire is the Infantry's best protection against low-flying hostile air attack.*

3. **Methods of protection.**—Infantry protects itself by concealment, by dispersion such that a remunerative target is not offered to enemy air forces, and by defensive fires. Whatever methods are adopted for protection against air attack, timely warning is essential to give the troops a chance to put the

measures into effect. This manual does not cover the details of aircraft information or antiaircraft tactics.

4. Aerial tactics.—*a.* There are four types of aircraft; observation, attack, bombardment, and pursuit, each of which is designed for a particular tactical mission. In general, the tactical doctrine of all countries prescribes the use of aviation to attack ground troops. The United States is the only country that has developed a special type of airplane with the attack of ground forces in mind as its chief mission. Other powers rely for the most part on the use of pursuit airplanes or light bombers.

b. Infantry may be subjected to an attack from the air either by day or by night. The attack may be made by machine-gun fire, fragmentation or chemical bombs, chemical spray, or any combination, and the attack may be preceded by smoke-laying airplanes.

c. The following methods of attack can be used by hostile air units against Infantry:

(1) *Low-flight attack.*—Attack by machine-gun fire and small fragmentation bombs with the attacking airplanes flying as close to the ground as possible—10 to 30 yards.

(2) *Diving attack.*—Attack by machine-gun fire and small bombs with the airplanes diving for some distance directly at the target, firing machine guns during the whole dive, and releasing the bombs near the lowest point of the dive.

(3) *High attack.*—Attack by bombs from altitudes above effective small-arms antiaircraft range—1,200 yards.

(4) *Gas attack.*—Attack by persistent gas, either sprayed or dropped in bombs, with airplanes flying at varying altitudes suitable to the method and wind conditions—10 to 750 yards.

(5) *Combined attack.*—Simultaneous attack by bombs and bullets and by gas with airplanes flying at altitudes indicated above according to their individual methods of attack.

SECTION II

INFANTRY ANTIAIRCRAFT FIRE

5. Maximum fire.—As a general rule, whenever Infantry fires at hostile aircraft it places all possible fire power upon the aerial target for as long a time as possible. The modern airplane is a very fleeting target. In 10 seconds it moves 1,000

yards. Hence it is of utmost importance to concentrate every weapon upon an enemy's airplanes as soon as they come in range and maintain intense fire until they pass out of range. The rifle, automatic rifle, and machine gun are used for anti-aircraft purposes. At very close ranges the pistol also contributes its fire, being used only by men and officers who are equipped with it and who are not engaged in other fire.

6. **Leads.**—*a.* In fire at any moving target, the target moves while the bullet travels the distance from the gun to the target. When the range is very short or when the target is moving directly toward or away from the gun the travel of the target may be disregarded and aim taken directly at the target.

b. In most infantry anti-aircraft fire, the speed of the target (hostile airplane) must be taken into account. The speed of the airplane is in fact comparable to the speed of a bullet, although much less. The caliber .30 bullet leaves the muzzle of a rifle or machine gun, moving 900 yards a second; an airplane moves 100 yards a second. The bullet rapidly slows down, losing half its speed in the first 625 yards and two-thirds of it after 1,000 yards of travel. Hence, for the purposes of this discussion, since all infantry anti-aircraft firing is done at ranges of 1,000 yards or less, we see that at 100 yards per second planes move from one-ninth to one-third as fast as a bullet.

c. This means, without going too deeply into the mathematics of the problem, that while a bullet is traveling 1,000 yards to reach an airplane, the airplane moves from 147 to 278 yards, depending upon its direction of flight with regard to that of the bullet. Naturally a bullet must go farther to overtake a fast airplane than to meet it; hence we have a distance of travel that varies with the relative direction of the bullet and the airplane.

d. Therefore, in order to hit a moving airplane from a stationary point on the ground, aim must be taken in such a way that the bullet and airplane, both moving, although one much faster than the other, meet in midair. To accomplish this, aim must be taken in nearly all cases ahead of the airplane. This distance, which depends on many different variable factors, is called the "lead." The "lead" in infantry anti-aircraft firing, as well as all other firing at moving targets, is no different in principle from the lead used in hunting. The same

obstacles are met in firing a shotgun at a winging bird, although the nature of the antiaircraft weapons and target makes the problem considerably more difficult.

e. The shotgun fires many bullets. The hunter tries to fire his gun so that some of these kill the bird. A very fine shot could doubtless shoot down an occasional bird with a rifle. But whichever weapon he used he would have to "lead" the flying bird in order to hit it unless it happened to fly directly toward him or directly away from him.

f. When Infantry fires its rifles at a hostile airplane it is very much the same as if a hunter were shooting ducks with a rifle. These are the main differences:

- (1) The airplane is much larger.
- (2) It moves much faster (roughly three times as fast).
- (3) It is usually much farther away.
- (4) Because it is farther away most of the time, it appears to move much slower than would a bird comparatively close to a hunter.

(5) Instead of one weapon to one target there are ordinarily hundreds and sometimes even thousands of weapons to one or a very few targets.

g. When Infantry fires its machine guns at enemy airplanes, the effect is not the same as that of a shotgun firing many bullets at the same time. It is more as if a rifle were fired with great rapidity since there is an appreciable period of time between the rounds a machine gun fires.

SECTION III

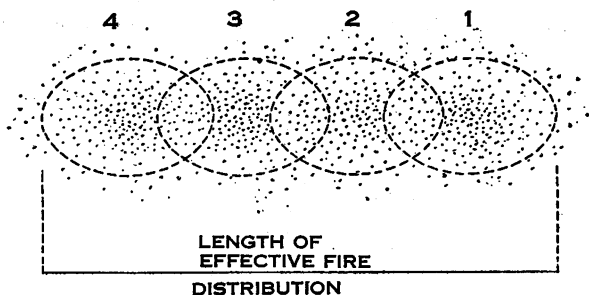
RIFLE AND AUTOMATIC RIFLE

7. General.—Rifle and automatic rifle antiaircraft marksmanship including the individual application and control of fire is fully covered in Chapter 2, Part Six, B. F. M., Volume III.

8. Fire distribution.—The antiaircraft fire of a rifle unit is distributed along the path of flight of the target by the prearranged combined lead (fig. 1) or by the single lead (fig. 2).

a. Figure 1 shows the best method to use with troops that have had little training. This method is also used in some cases by well-trained troops when a wide distribution is desirable. The several leads used are prearranged, each man fires with the number of target-length leads corresponding to

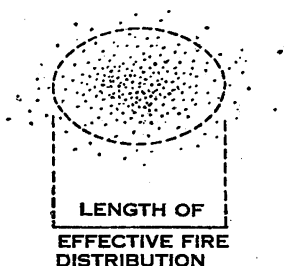
his number in the squad, or each squad in a platoon fires with the number of target-length leads corresponding to its number in the platoon.



The fire of all weapons firing at a given lead, as shown above, is distributed over a wide oval. The ovals made at each lead used overlap. The fire of all weapons covers a much wider space, but is correspondingly thinner.

FIGURE 1.—Antiaircraft rifle fire with combined leads.

b. Figure 2 shows the best method to use with well-trained troops who can estimate target-length leads accurately.



Because of various human errors the fire is distributed over from one to three target lengths, depending on the length of the lead taken.

FIGURE 2.—Antiaircraft rifle fire distribution with a single lead.

9. Target designation.—a. Depending on the type of attack, the kind of target being attacked, and the area the enemy hopes to cover, the attack may be delivered in many possible ways. It can be expected however that when the hostile forma-

tions consist of several or many airplanes, these will be subdivided for aerial control into small groups of two or, more likely, three airplanes. This is apt to be the case except when the enemy attacks with gas over a large area.

b. Any small infantry fire unit, such as a squad or section, is not likely to encounter at any one time during an attack

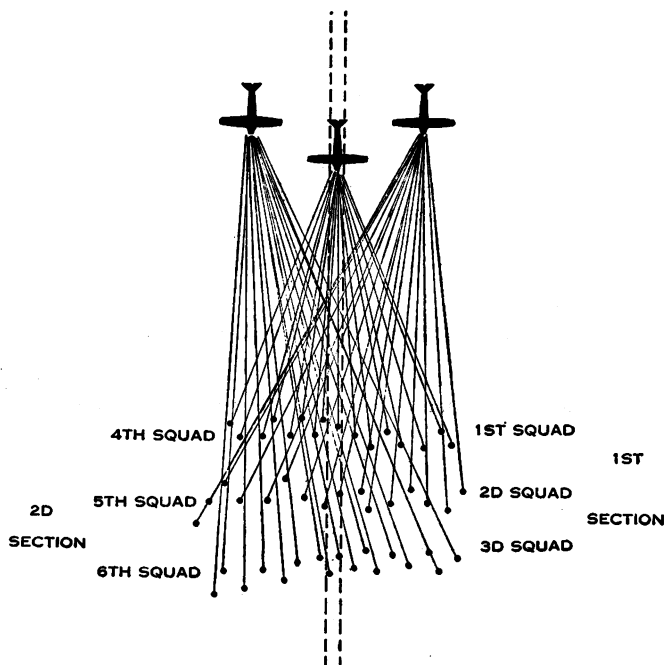


FIGURE 3.—A suitable method of distributing the antiaircraft fire of a rifle platoon.

more than one group of two or three airplanes. In such a group it is desirable to place fire on all the airplanes.

a. (1) It is important that small infantry units be assigned different targets. This is done by a standard assignment to each unit in the column of a target and an alternate target. Owing to the rapidity of air attacks and their short duration, it is impracticable to designate targets after the at-

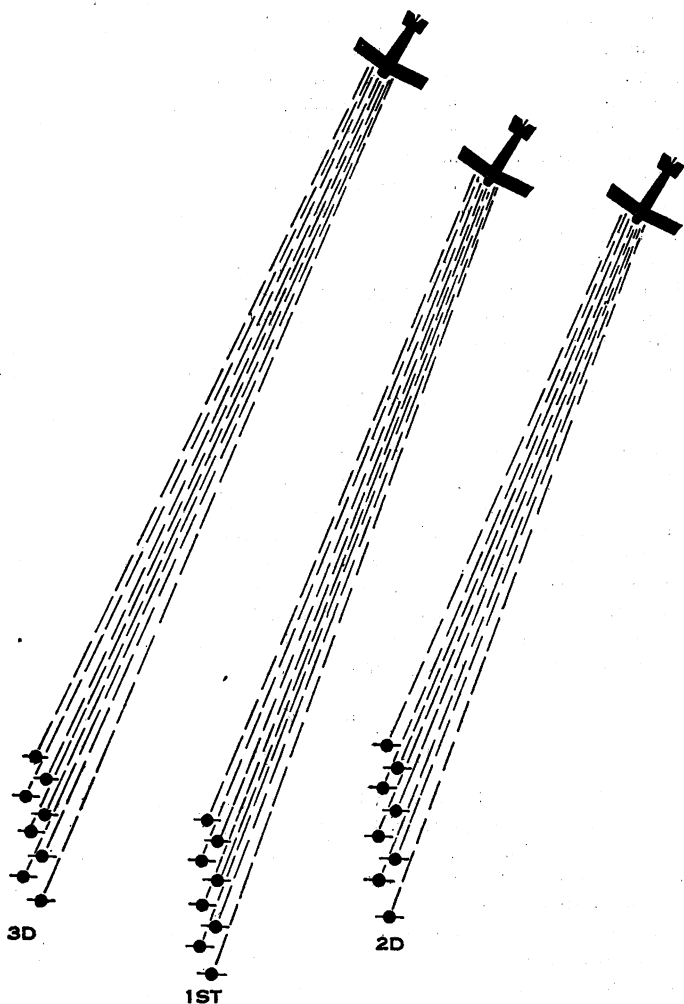


FIGURE 4.—Antiaircraft fire distribution of a rifle section marching across country in squad columns.

tack has been launched. Target designation must therefore be made prior to entering the area of probable attack. The designation of targets is made by section, platoon, or company. One method, assuming that the enemy customarily uses a three airplane element, is to assign the center or leading airplane to the first squad of the section, the right airplane to the second squad, and the left airplane to the third squad, with further instructions that when an attack comes any unit, not having a target thus assigned, fires on the leading airplane. (See figs. 3 and 4.)

(2) The same method of assigning targets can be applied to the platoon and company. The normal period of such assignment of targets is from its initial appearance until the attack is out of range. Should a succession of elements attack, the unit leader causes his unit to cease firing at one group in time to bring fire to bear on the next as it comes within effective range.

d. The rate of fire at aerial targets is about the same as the rapid-fire rate at ground targets. Everything must be done to increase the rate of fire without affecting its accuracy. Each shot must be aimed and squeezed. A well-trained rifleman is able to fire one aimed shot in about 3 seconds; a well-trained automatic rifleman, two shots in about 3 seconds. Assuming that attacking airplanes are within firing range for about 10 seconds, each rifleman and automatic rifleman can fire about 3 and 6 shots, respectively, at each attack element.

SECTION IV

MACHINE GUN

10. General.—The speed with which attack aviation strikes makes it mandatory that infantry machine-gun antiaircraft technique be simple and also be capable of automatic application. Antiaircraft fire demands a flexible weapon. To obtain this flexibility with the machine gun, the elevating and traversing mechanisms are unclamped, thus permitting the gun to be freely raised and lowered, and turned in any direction. This free suspension results in a considerably greater dispersion since the gun vibrates more during firing, the antiaircraft cone of fire being about four times the area of that delivered against ground targets with the gun clamped.

11. **Range.**—The maximum range at which accurate fire with the .30 caliber machine gun can normally be delivered against aerial targets is 1,000 yards. Beyond that range, dispersion and other factors make the chance of hits too slight.

12. **Method of fire.**—*a.* In antiaircraft marksmanship the gunner is trained to place the center of the cone of fire on the aerial target and to keep it there as long as the target is within range by continually moving the gun. This is done by using tracer ammunition. He also learns how to control his gun so that vibration and the resulting dispersion are reduced to the minimum. When in readiness for an air attack each gun is half loaded and lightly clamped in a vertical position. Upon the sounding of the antiaircraft alarm, it is fully loaded and unclamped. The technique of aiming and firing is covered in Chapter 3, Part Six, B. F. M., Volume III.

b. The machine-gun section of two guns is the fire unit. The section leader is responsible for the recognition of hostile airplanes and giving the order to fire. To insure safety he permits no fire over unsheltered friendly troops at an angle of less than 10°. As a target approaches he designates it by pointing and commanding: **ENEMY PLANES.**

c. Fire is opened as soon as the airplanes come within effective range and continues as long as they are within such range.

13. **Distribution of fire.**—*a. Defense of a marching column against air attack.*—The problem of fire distribution is simplest in the defense of a column on the road. Here the direction of attack is determined to a large extent by the road itself. The hostile target over any section of road is whatever element the enemy employs against that particular part of the road. When the hostile airplanes attack by twos, the odd-numbered sections fire on the enemy's right airplane and the even-numbered sections on the enemy's left airplane. (See fig. 5.) At three airplanes, all guns fire on the center airplane. If there are more than three hostile airplanes in close formation, all guns adjust on the center element as viewed from the front or rear, or the leading element as viewed from the flank. (See figs. 5 and 6.) If the column is marching across country the direction of attack is not so well-defined by the troop formation. However the same type of fire distribution is used. As shown in figure 6, all guns fire at the leading airplane. During most of the firing their fire thus includes at least two airplanes.

b. Defense of a bivouac or other area.—In the defense of an area each machine-gun platoon is assigned a definite sector of responsibility. (See figs. 7 and 8.) In figure 7 there are many

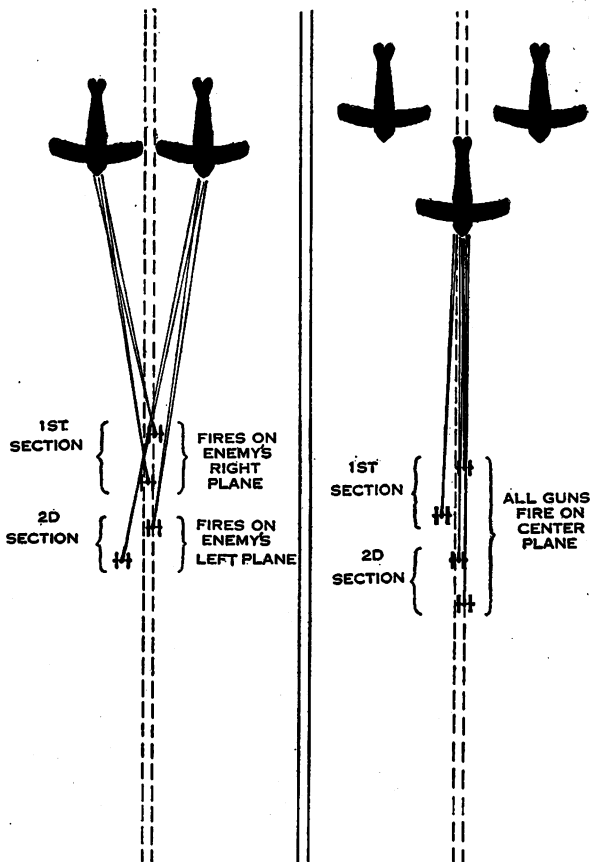


FIGURE 5.—Distribution of machine-gun antiaircraft fire. Left: At two airplanes. Right: At three airplanes.

possible routes of approach for the air attack, and the terrain permits an all-around defense. The circles show the area covered by each of the three platoons. All guns are placed out far

enough so that nearby woods do not mask their fire. All guns are emplaced to permit all-around fire as far as possible. Especial safety precautions must be taken regarding overhead fire within platoons. Shaded sectors show the direction of approach within platoons. Shaded sectors show the direction of approach

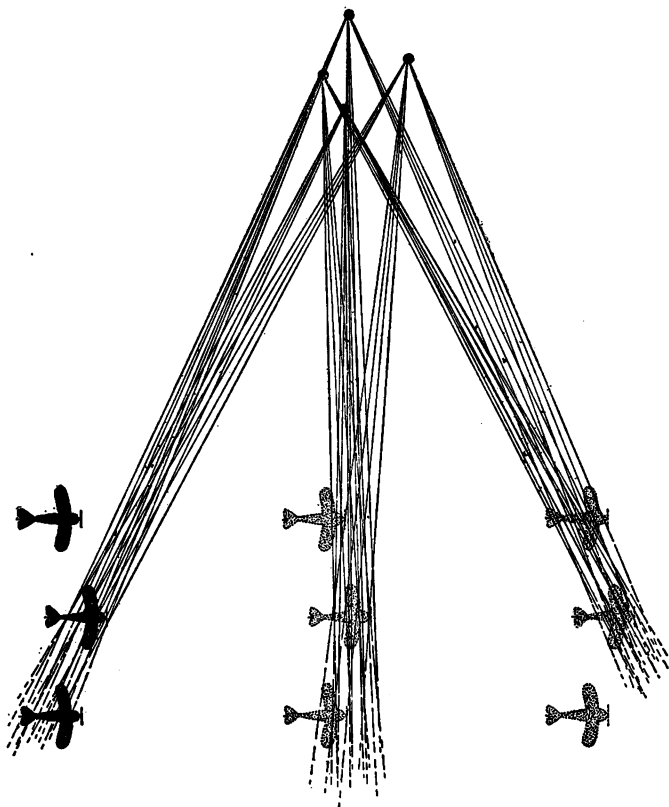


FIGURE 6.—Fire distribution of a machine-gun platoon at three airplanes.

especially watched by each platoon. Figure 8 shows all guns placed for all-around fire where possible. The shaded sectors and arrows indicate the directions of hostile approach that each platoon especially guards.

Within the platoon the section is still the fire unit. The sector limits are indicated by landmarks. Each platoon is

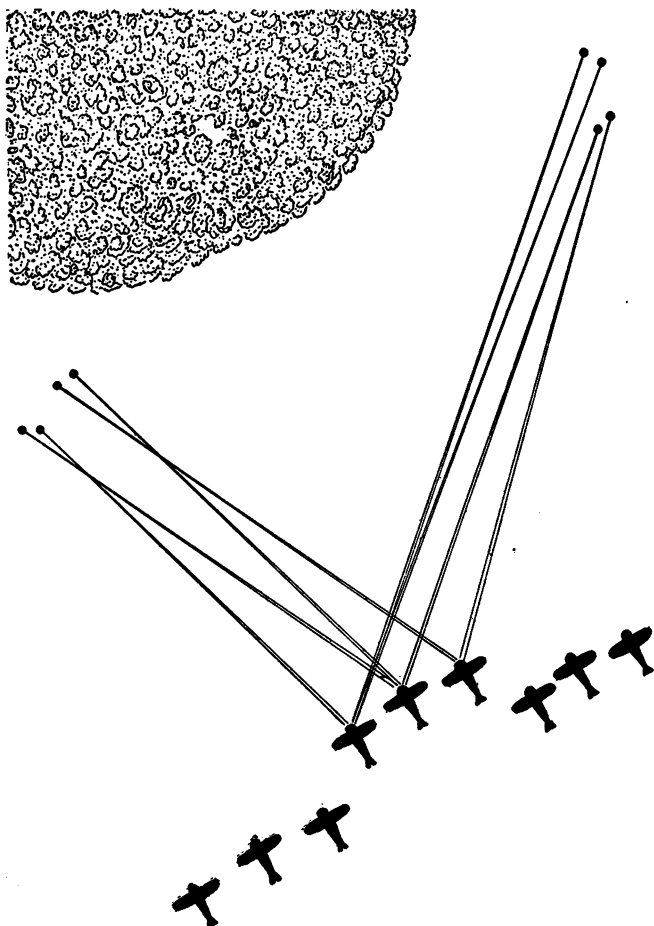


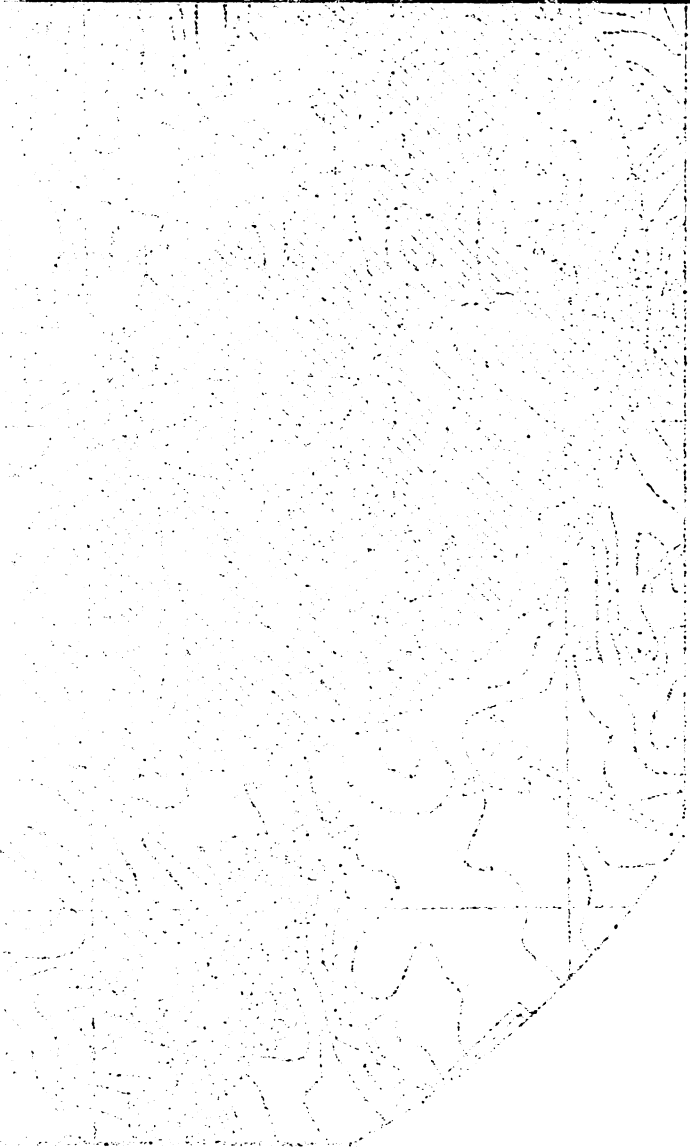
FIGURE 9.—Fire distribution of two machine-gun platoons defending one side of a bivouac area.

responsible for meeting with fire any attack that approaches its sector from any direction. When no part of the attack comes



GRID SQUARES REPRESENT 1000 YARDS

FIGURE 7.—Defense of a battalion bivouac area with one machine-gun company.



FRANCE 1870

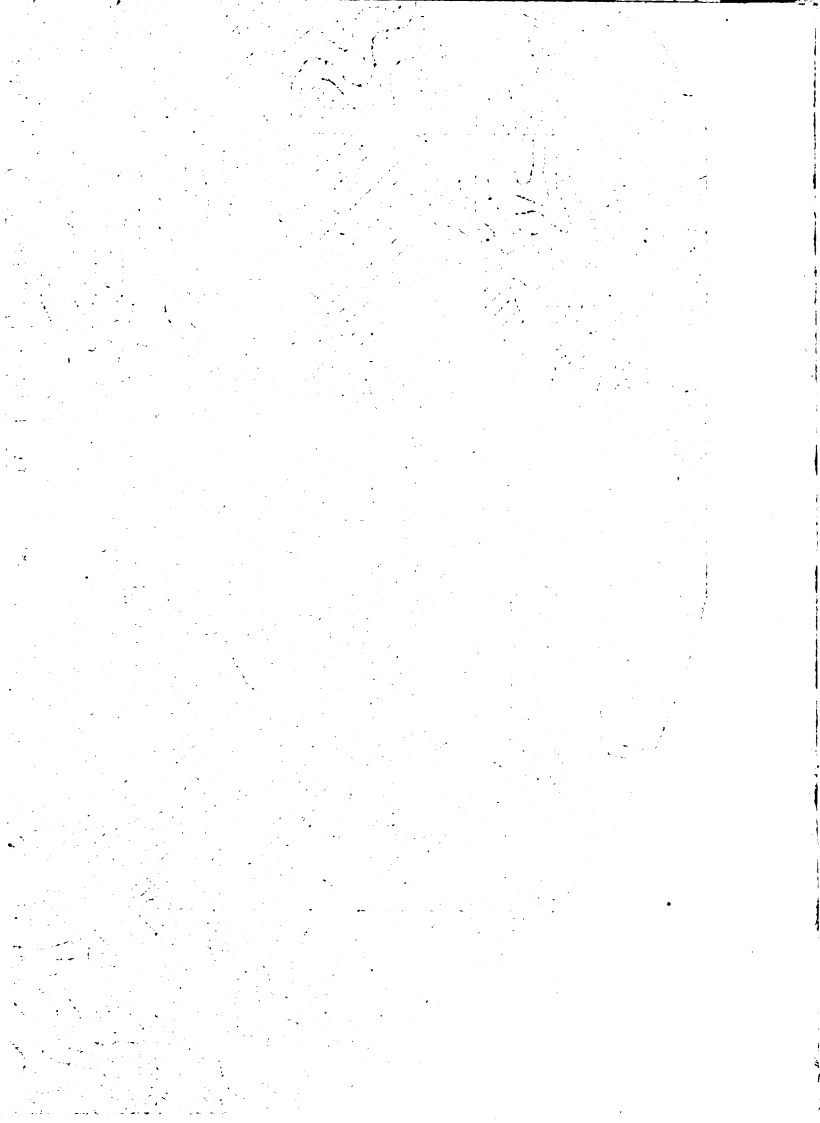
1870-1871



GRID SQUARES REPRESENT 1000 YARDS

FIGURE 8.—Antiaircraft defense of a battalion bivouac with one machine-gun company (12 guns) and the twelve machine guns of the three rifle companies.

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toward its sector, the sections of the platoon fire on any aerial target within range. Hostile attacks must be met with fire and kept under the fire of all guns possible until the attack has passed out of range. When the enemy attacks in formation, each gun adjusts on the leading element of the formation. If the attack consists of two or more formations, each section fires on the formation which is nearest. (See figs. 9,

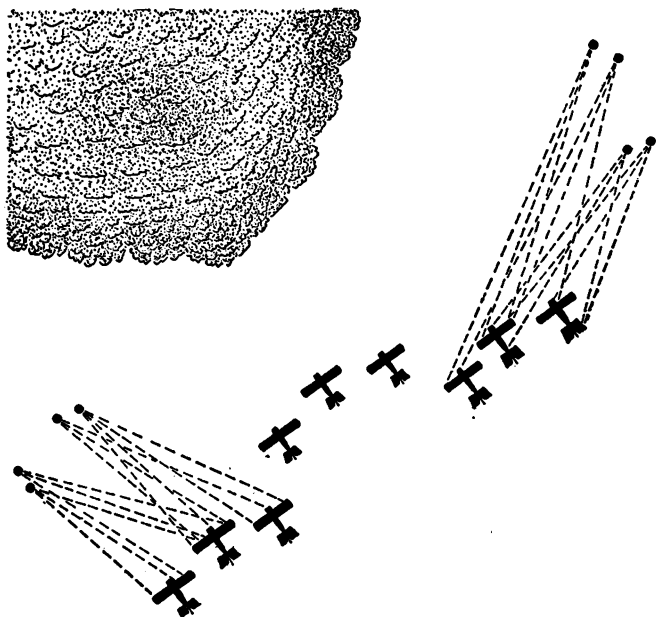


FIGURE 10.

10, and 11.) All guns open on the nearest element of the nine-airplane attack as it comes within range (fig. 9). As the attack comes closer all guns shift to the elements that pass closest (fig. 10). As the airplanes pass by, the machine gun fire that comes from a flank is kept direct at the nearest element. It may often include also more than one element when it is so directed (fig. 11). If during the course of an attack a second hostile echelon appears, it must also be met with

fire by the units that are in or near its path. Constant observation and alertness are thus necessary throughout an air attack.

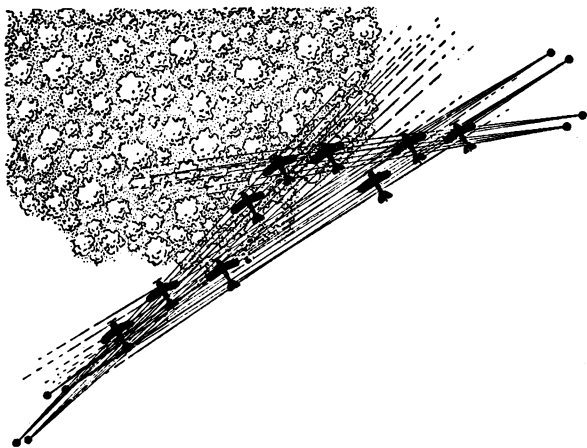


FIGURE 11.

SECTION V

EFFECT OF INFANTRY ANTIAIRCRAFT FIRE

14. Antiaircraft fire power of infantry units.—*a.* The infantry antiaircraft fire power of any unit expressed in rounds fired in a given time may be determined by consulting the table below and multiplying by the number of rifles, automatic rifles, and machine guns.

Duration of fire	Rounds		
	Rifle	Automatic rifle	Machine gun, .30 caliber
3 seconds.....	1	2	30
6 seconds.....	2	4	60
9 seconds.....	3	6	90

b. Many factors tend to reduce the maximum antiaircraft fire power. The terrain may prevent any ground fire at all, as in thick, heavy woods. Visibility may prevent firing, as on dark nights. Jams and stoppages may reduce the quantity of fire. The factors of safety in firing over the heads of friendly troops may limit the duration of fire when troops cannot deploy sufficiently to prevent such interference.

c. Nevertheless the aggregate of infantry's fire power against an aerial attack that comes within its range is evidently very large in the great majority of cases, and especially when anti-aircraft measures are constantly taken. The fire of a single battalion is seldom apt to be required against more than three hostile airplanes at a time. Thus each such airplane is likely to have several hundred rounds of fire directed against it in a few seconds' time.

15. Accuracy of infantry fire.—a. It is impossible to do much more than conjecture what the accuracy of any fire will be in battle. Firing in time of peace indicates, however, that trained antiaircraft fire is effective and should cause substantial losses to hostile air units. The results of firing at sleeve targets moving from 100 to 120 miles an hour vary all the way from 0.5 to above 10.0 percent hits out of shots fired. The higher percentages are obtained at low coming (overhead) targets or close passing targets (within 200 to 300 yards) that simulate the air attack. The sleeve target ordinarily used in antiaircraft firing is roughly the size of the vital area of a modern attack airplane. It is well worth noting, as an indication of the probability of hits, that even as few as 1.0 percent hits from half the weapons of an infantry battalion would, in three seconds, result in two hits in the vital areas of three attacking hostile airplanes. Conditions, and hence results, will usually be more favorable than those just assumed.

b. High speed of target.—The high speed of the modern airplane has its chief effect in reducing the duration of infantry antiaircraft fire. Greater leads are necessary for a given range at greater speeds. But on the whole 200, or even 300, miles an hour will not stop infantry antiaircraft fire from hitting and bringing down hostile airplanes.

16. Effect of caliber .30 fire on the airplane.—a. There are all degrees of possible damage to an airplane from the fire of infantry. Hits upon the cylinder walls and other important

working parts are likely to stop an engine immediately. The caliber .30 ball readily penetrates the thin ($\frac{1}{8}$ inch thick), highly brittle materials of which the modern airplane engine walls are made. During the World War bullets stopped hundreds of airplane engines, engines far heavier and sturdier of resistance to fire than those of today. A hit through the metal propeller is also serious, since it throws the engine out of balance. If the pilot is struck at low altitudes a crash is almost certain to take place. Unless the bombs carried by the airplane are bullet-proof, hits by armor-piercing small-arms bullets will detonate them.

b. There are also many lesser ways in which infantry fire can damage an airplane. Holes through the crankcase may cause the oil to drain out and the engine to freeze before the airplane returns to friendly territory. Hits of any kind, in fact, require varying degrees of repair, if they do not cause the destruction of the airplane.

17. Moral effect of infantry antiaircraft fire.—The moral effect of infantry antiaircraft fire was an important factor in the World War. Missions against ground units were deservedly considered dangerous.

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Abstract: The purpose of this study was to determine the effect of a 12-week training program on the heart rate (HR) and blood pressure (BP) of sedentary, middle-aged men. The subjects were divided into two groups: a control group and an exercise group. The exercise group performed a 12-week training program consisting of three sessions per week, each lasting 30 minutes. The control group did not participate in any exercise program. The HR and BP were measured at baseline and at the end of the 12-week period. The results showed that the exercise group had a significant decrease in both HR and BP compared to the control group. The HR decreased from 72 to 68 beats per minute, and the BP decreased from 120/80 to 110/70 mmHg. The control group showed no significant changes in HR and BP. The study concluded that a 12-week training program can effectively reduce HR and BP in sedentary, middle-aged men.

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